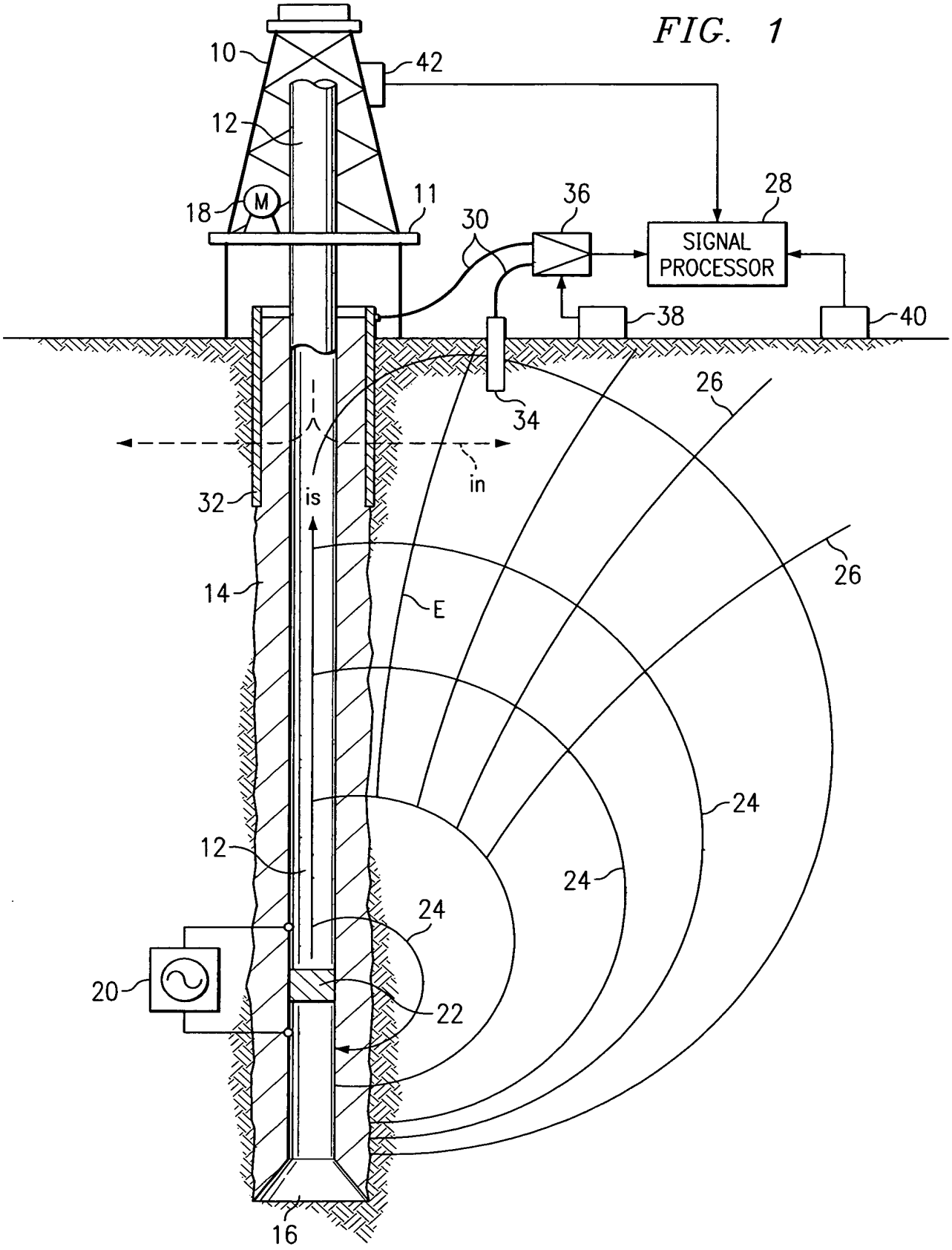
FIG. 1


10
42
12
18
M
11
30
36
28
SIGNAL PROCESSOR
38
40
34
26
32
is
in
14
E
26
24
12
24
24
20
22
16

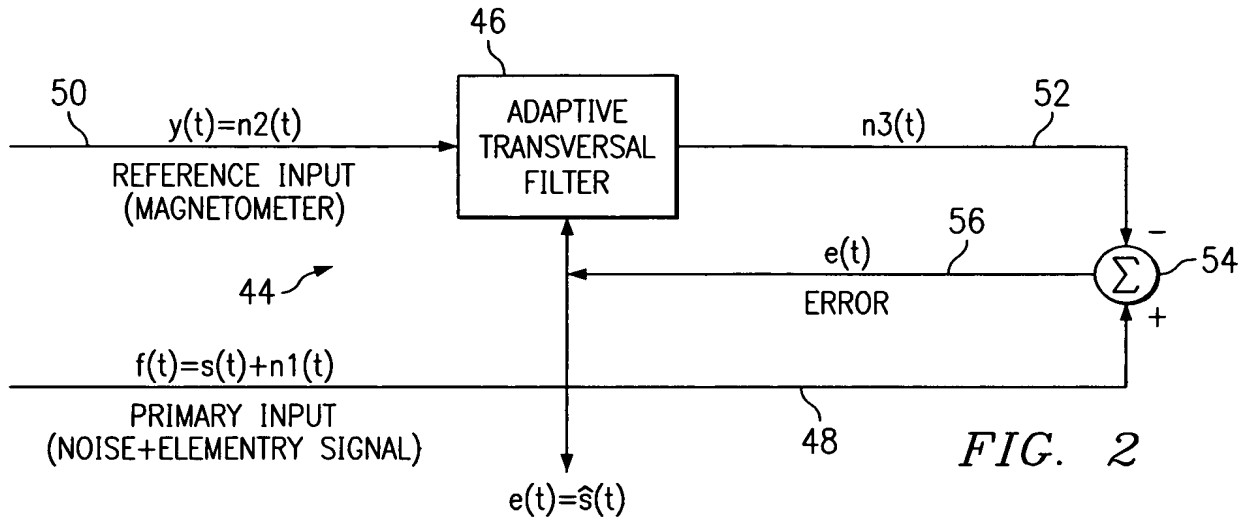


FIG. 2

WHERE n1(t) IS A LINEAR FUNCTION OF n2(t)

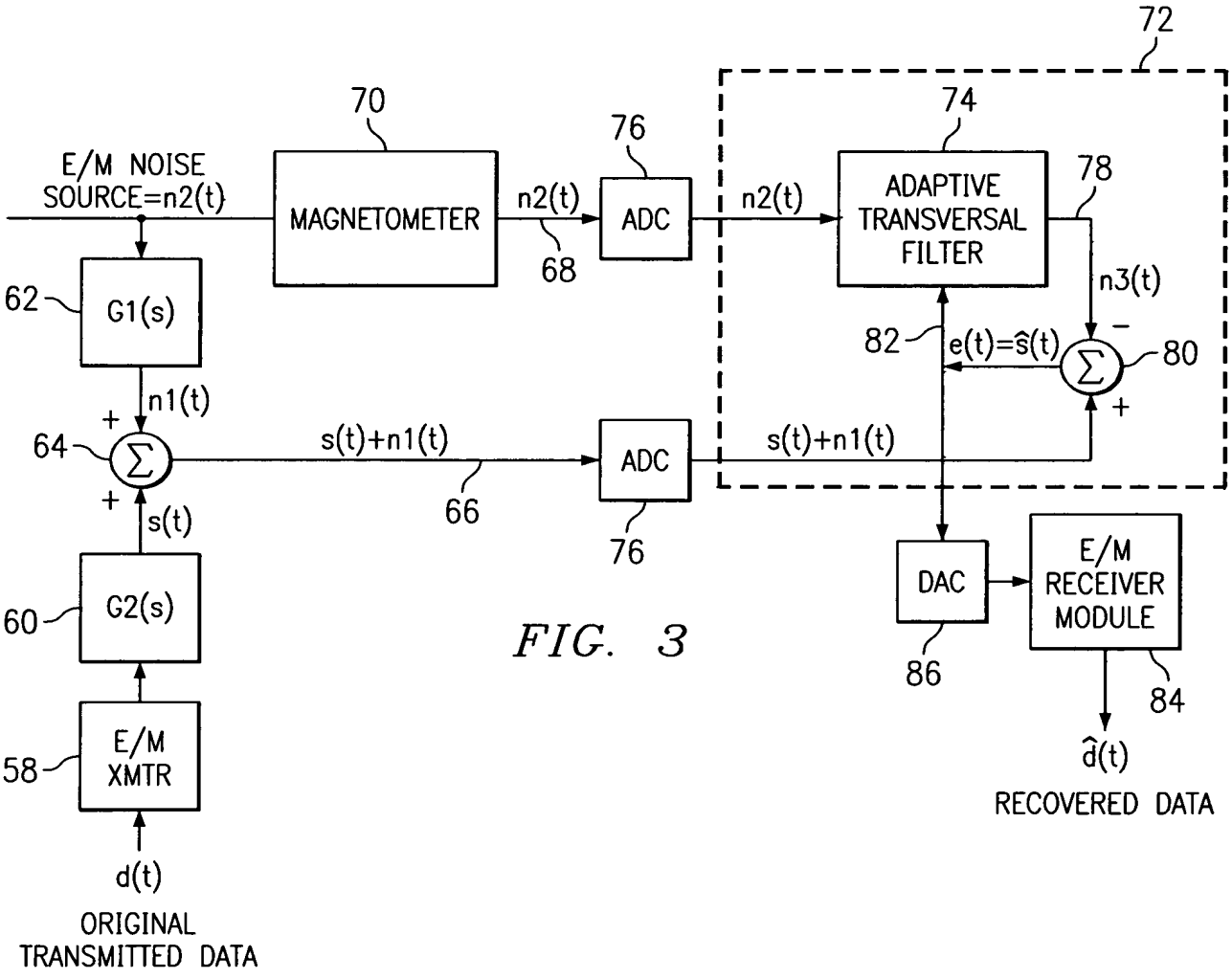


FIG. 3

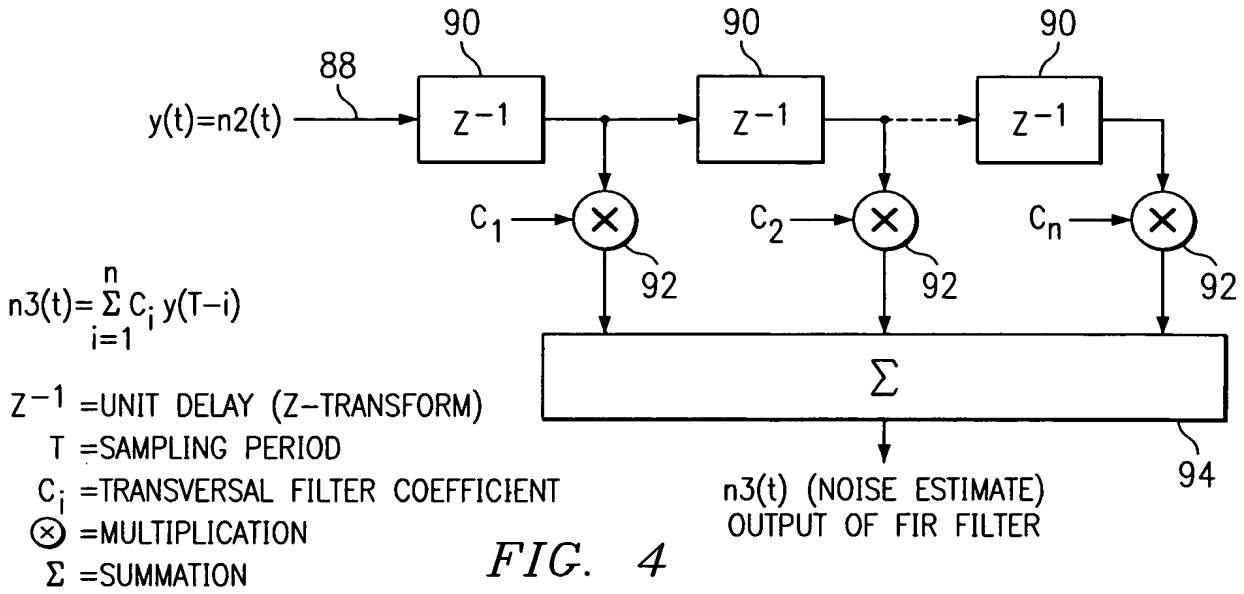

90
90
90
88
y(t)=n2(t)
Z⁻¹
Z⁻¹
Z⁻¹
C1
C2
Cn
92
92
92
Σ
94
n3(t)= Σ Ci y(T−i)
i=1
Z⁻¹ =UNIT DELAY (Z-TRANSFORM)
T =SAMPLING PERIOD
Ci =TRANSVERSAL FILTER COEFFICIENT
⊗ =MULTIPLICATION
Σ =SUMMATION
n3(t) (NOISE ESTIMATE)
OUTPUT OF FIR FILTER

FIG. 4

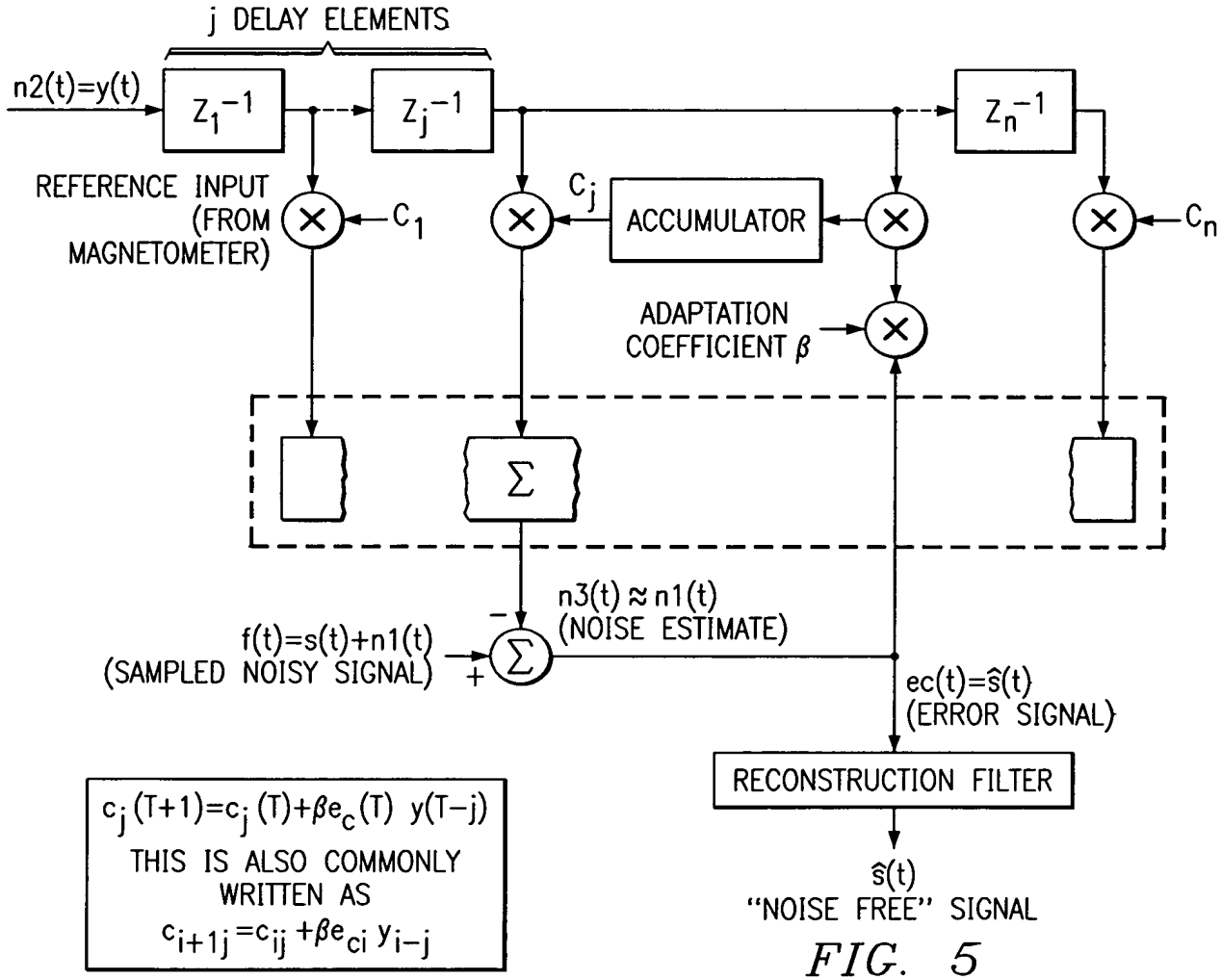

j DELAY ELEMENTS
n2(t)=y(t)
Z1⁻¹
Zj⁻¹
Zn⁻¹
REFERENCE INPUT
(FROM
MAGNETOMETER)
C1
Cj
ACCUMULATOR
Cn
ADAPTATION
COEFFICIENT β
Σ
n3(t) ≈ n1(t)
(NOISE ESTIMATE)
f(t)=s(t)+n1(t)
(SAMPLED NOISY SIGNAL)
−
+
ec(t)=ŝ(t)
(ERROR SIGNAL)
RECONSTRUCTION FILTER
ŝ(t)
"NOISE FREE" SIGNAL
cj(T+1)=cj(T)+βec(T) y(T−j)
THIS IS ALSO COMMONLY
WRITTEN AS
ci+1j=cij+βeci yi−j

FIG. 5

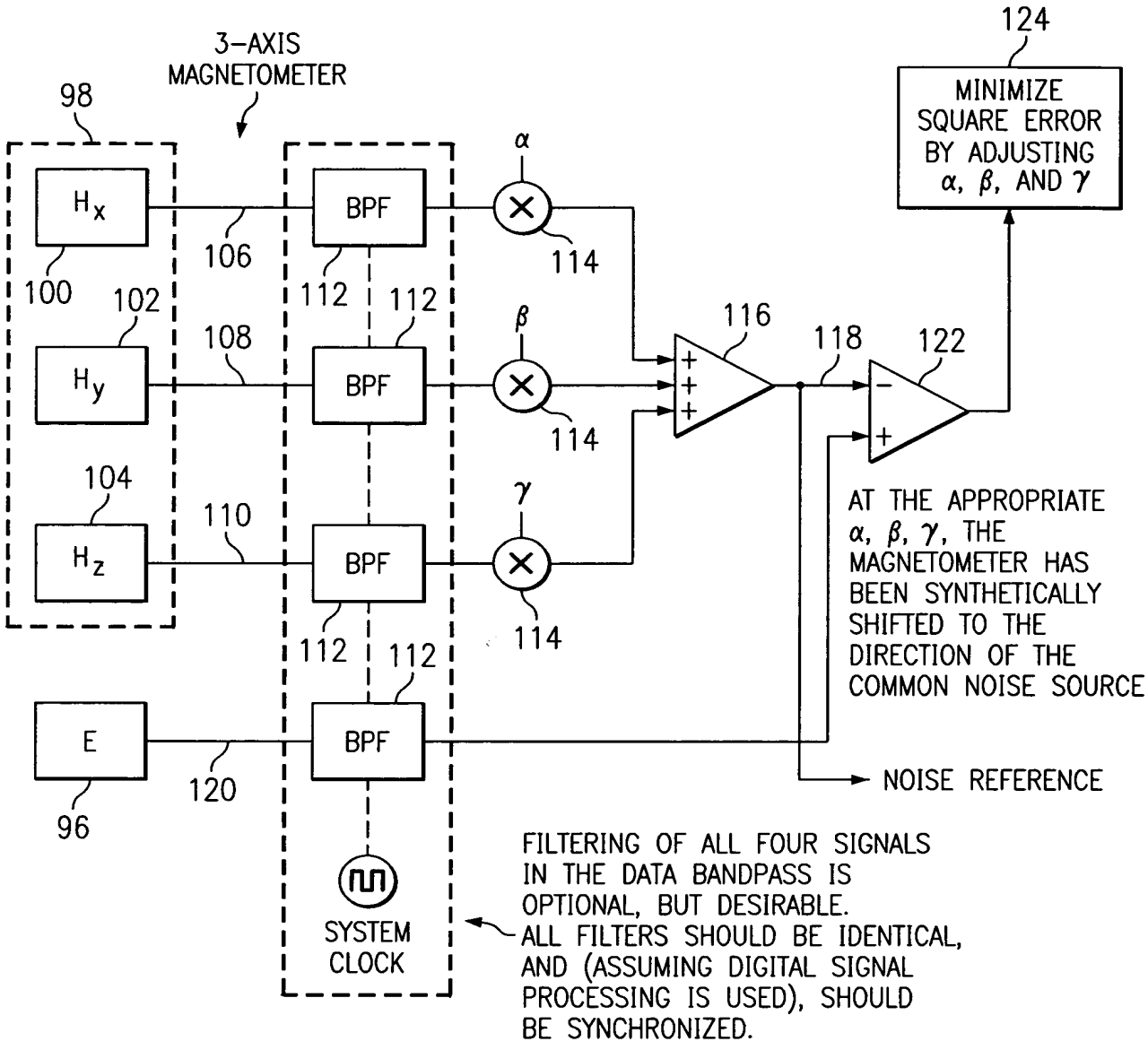

3-AXIS MAGNETOMETER
98
H_x
H_y
H_z
E
100
102
104
96
106
108
110
120
BPF
112
α
β
γ
114
116
118
122
124
MINIMIZE SQUARE ERROR BY ADJUSTING α, β, AND γ
AT THE APPROPRIATE α, β, γ, THE MAGNETOMETER HAS BEEN SYNTHETICALLY SHIFTED TO THE DIRECTION OF THE COMMON NOISE SOURCE
NOISE REFERENCE
SYSTEM CLOCK
FILTERING OF ALL FOUR SIGNALS IN THE DATA BANDPASS IS OPTIONAL, BUT DESIRABLE. ALL FILTERS SHOULD BE IDENTICAL, AND (ASSUMING DIGITAL SIGNAL PROCESSING IS USED), SHOULD BE SYNCHRONIZED.

FIG. 6

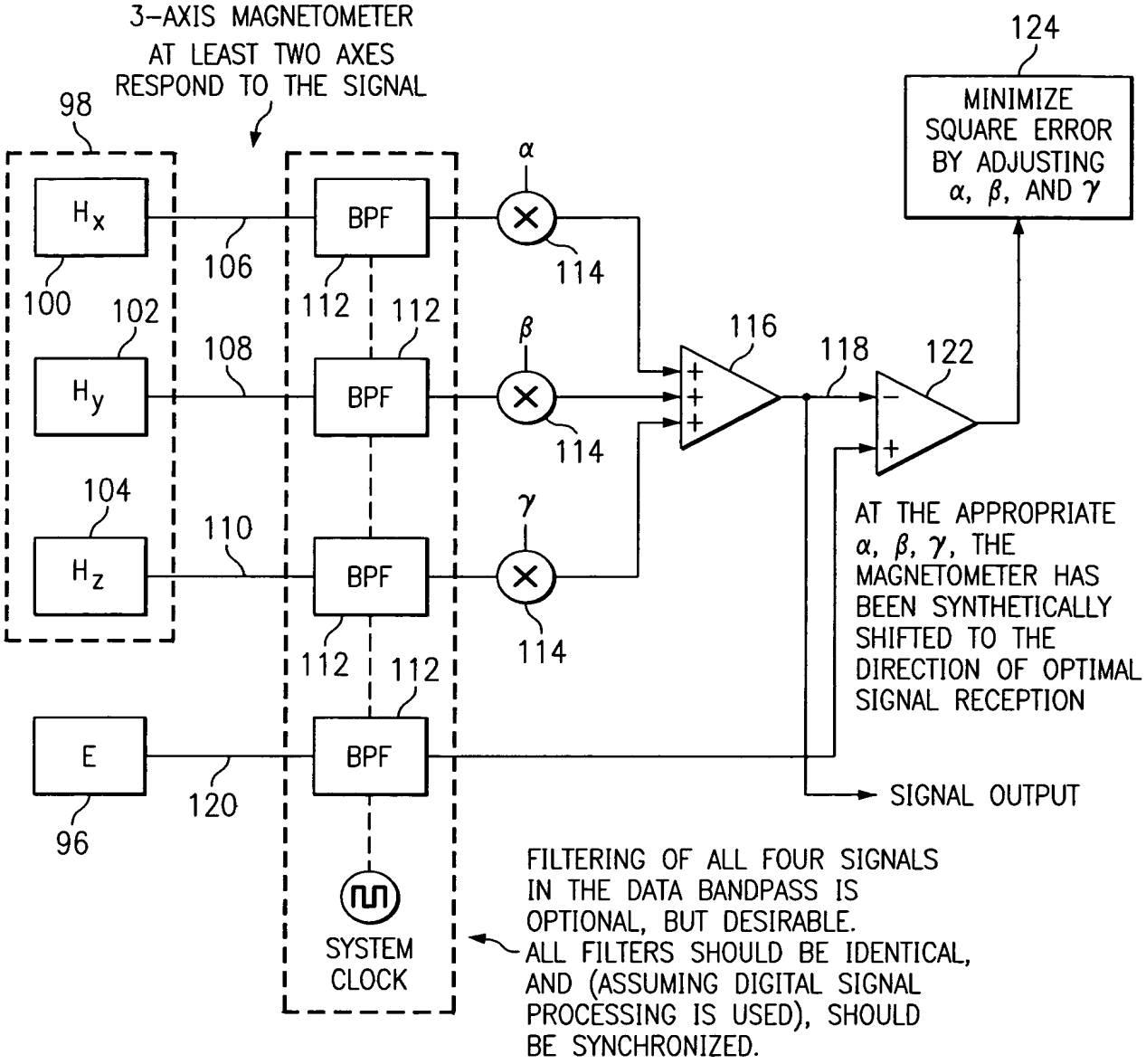

3-AXIS MAGNETOMETER
AT LEAST TWO AXES
RESPOND TO THE SIGNAL
98
H_x
H_y
H_z
100
102
104
106
108
110
BPF
112
α
β
γ
114
116
118
122
124
MINIMIZE SQUARE ERROR BY ADJUSTING α, β, AND γ
AT THE APPROPRIATE α, β, γ, THE MAGNETOMETER HAS BEEN SYNTHETICALLY SHIFTED TO THE DIRECTION OF OPTIMAL SIGNAL RECEPTION
SIGNAL OUTPUT
E
96
120
SYSTEM CLOCK
FILTERING OF ALL FOUR SIGNALS IN THE DATA BANDPASS IS OPTIONAL, BUT DESIRABLE. ALL FILTERS SHOULD BE IDENTICAL, AND (ASSUMING DIGITAL SIGNAL PROCESSING IS USED), SHOULD BE SYNCHRONIZED.

FIG. 7

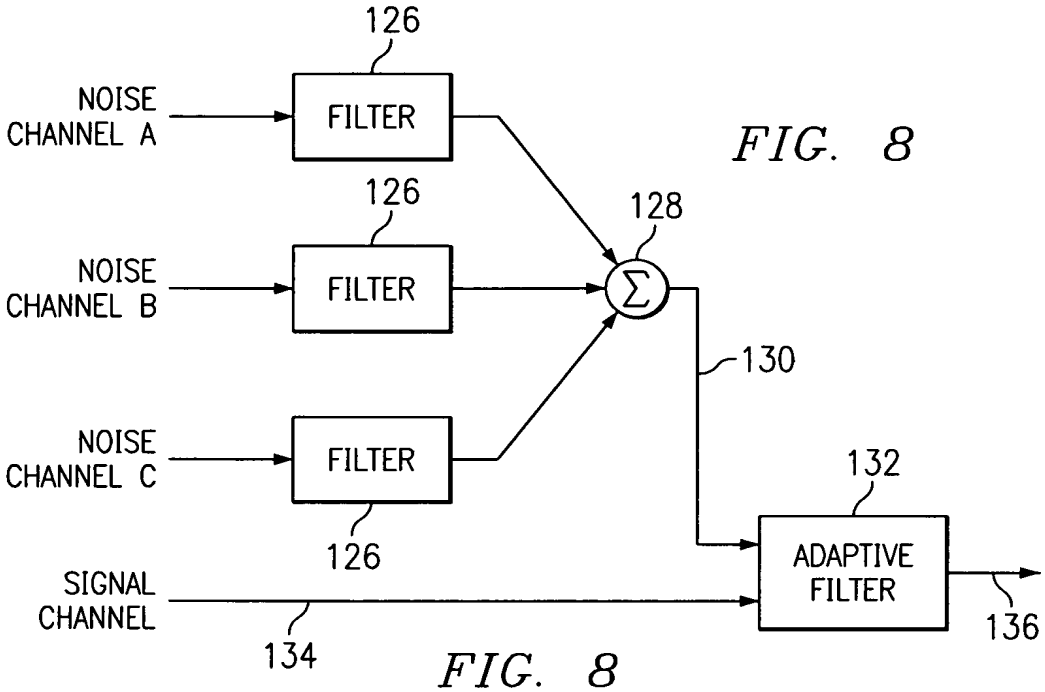

126
NOISE CHANNEL A
FILTER
126
NOISE CHANNEL B
FILTER
128
Σ
130
NOISE CHANNEL C
FILTER
126
132
ADAPTIVE FILTER
136
SIGNAL CHANNEL
134

FIG. 8

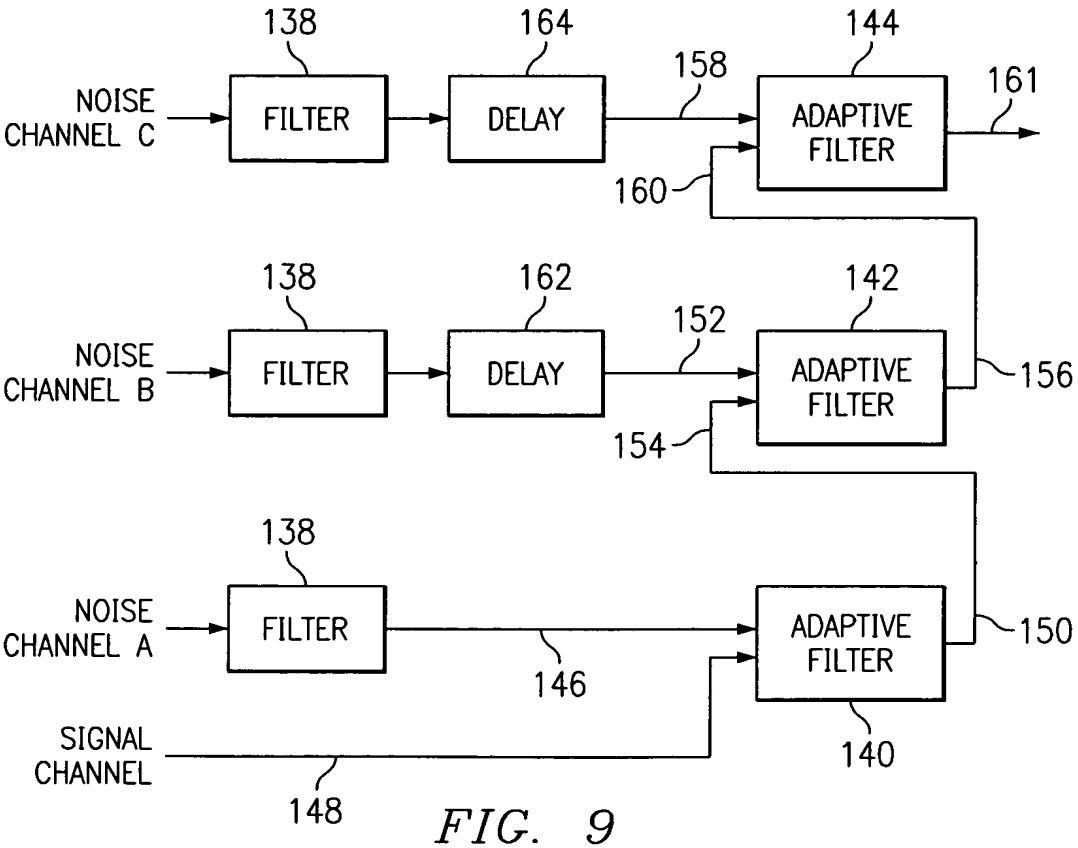

138
164
144
158
161
NOISE CHANNEL C
FILTER
DELAY
ADAPTIVE FILTER
160
138
162
142
152
NOISE CHANNEL B
FILTER
DELAY
ADAPTIVE FILTER
156
154
138
NOISE CHANNEL A
FILTER
ADAPTIVE FILTER
150
146
140
SIGNAL CHANNEL
148

FIG. 9